Greenhouse Gas Emissions Scenarios for the West Coast Region

California Climate Change Advisory Committee

San Francisco, January 18, 2005

Michael Lazarus, Tellus Institute/SEI

TELLUS INSTITUTE
Resource and Environmental Strategies

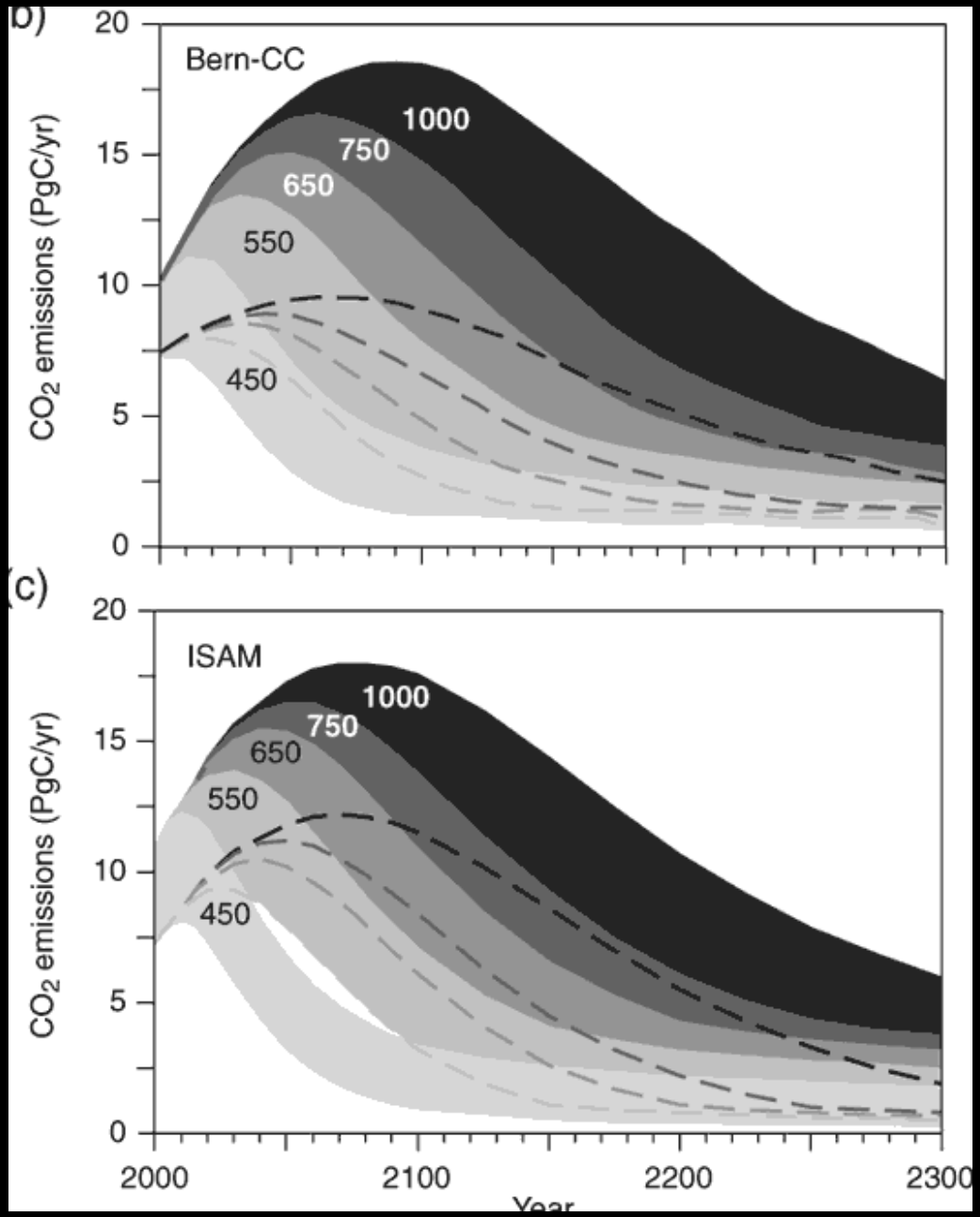
SEI STOCKHOLM ENVIRONMENT INSTITUTE

Overview of presentation

- "Turning the Corner on Global Warming Emissions: An Analysis of Ten Strategies for California, Oregon, and Washington", Aug 2004
  - Objectives and methods
  - Strategies considered
  - Key findings
  - Further revisions to CA emissions projections

Global CO2 emissions and climate stabilization scenarios (IPCC, 2001)

- limiting temperature to 2ºC (dangerous interference threshold?) may require stabilizing at 450 ppm CO2
- 450-550 ppm targets imply corner must be turned soon, globally



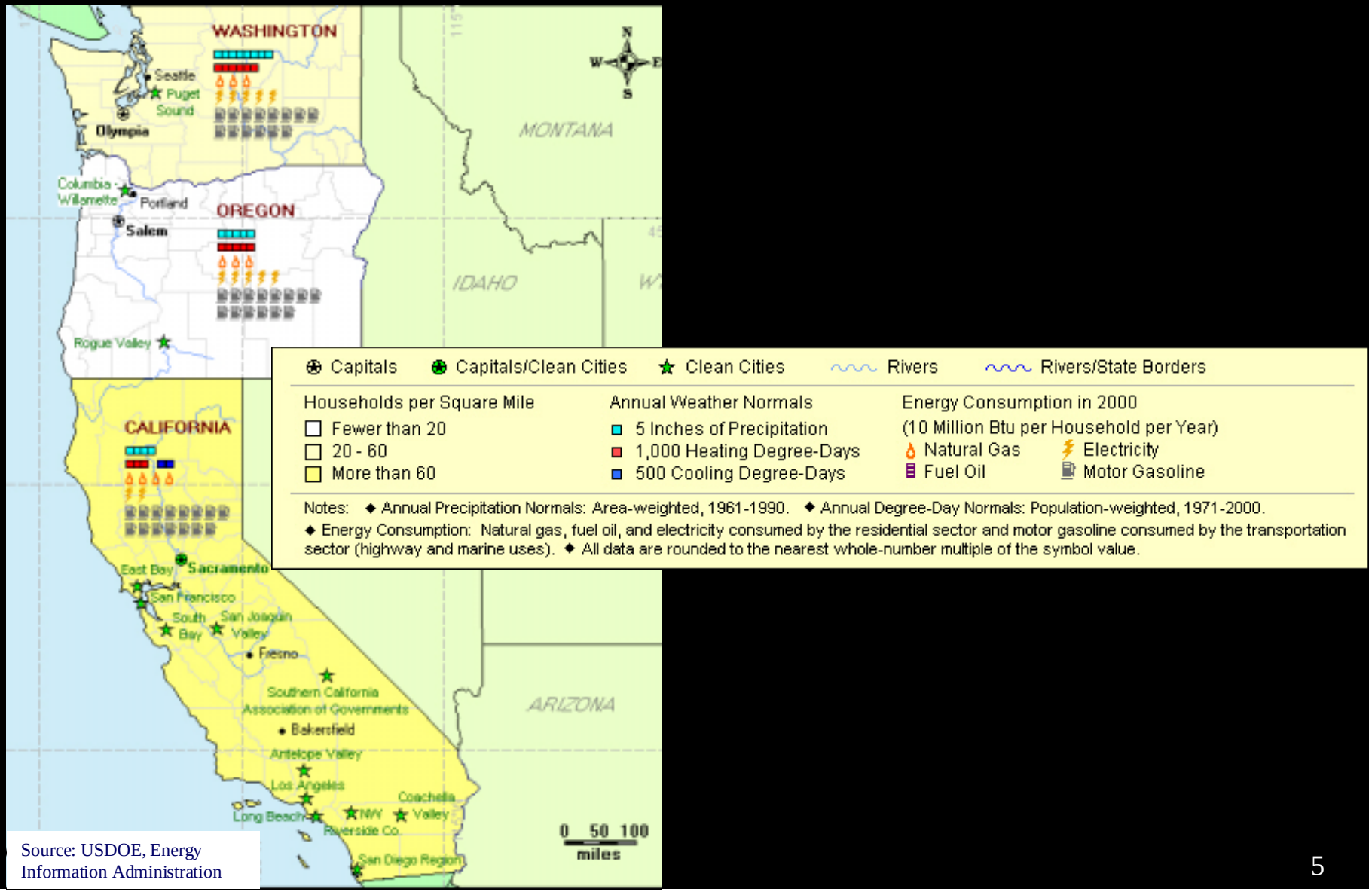
Upper bound - top of shaded area; Lower bound - bottom of shaded area, or dashed line if otherwise hidden

Study Objectives

Prepared for the West Coast Governors' Global Warming Initiative with support from the Energy Foundation to:

- Contribute to discussions regarding achievable emission reductions
- Consider a mix of ten strategies that provide cost savings and co-benefits, and prepare for longer-term reductions
- Complement existing work being done in the states
- Provide credible initial estimates, rather than definitive results

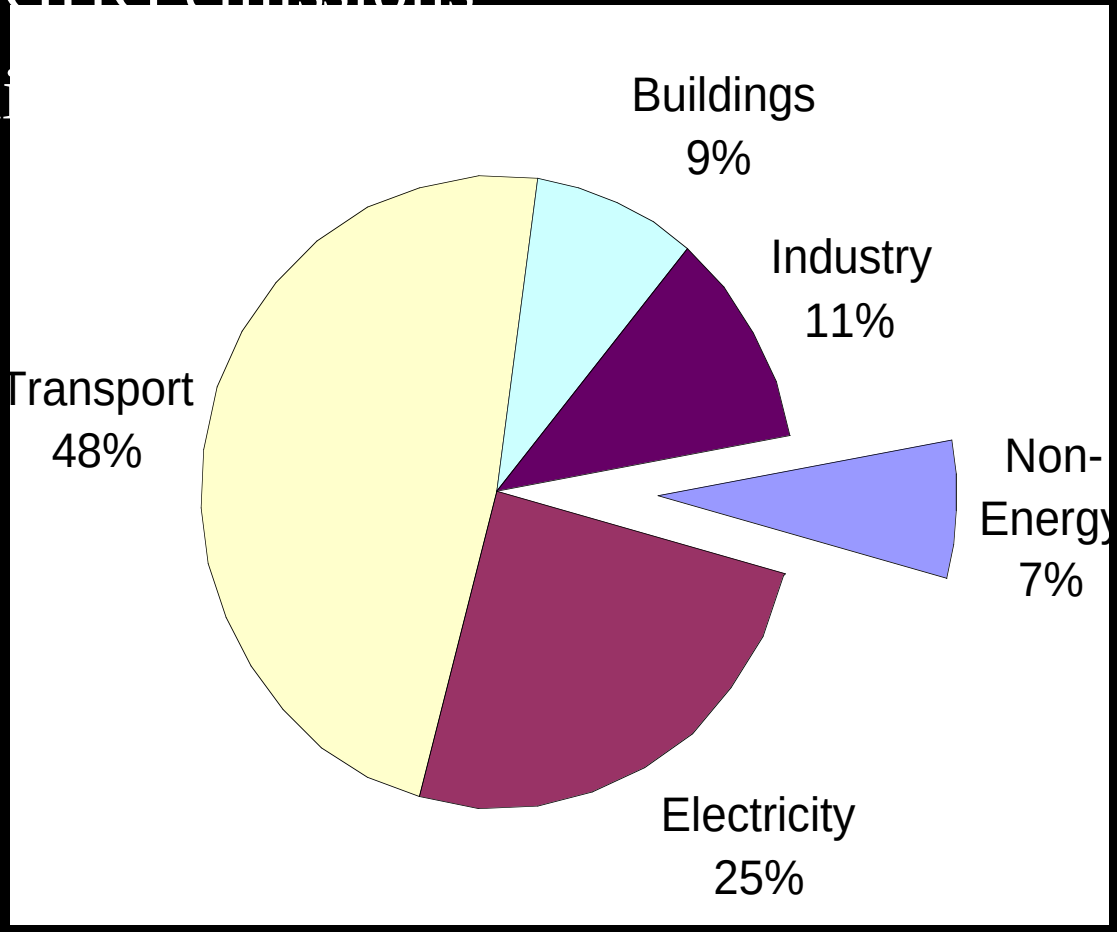
Energy-related Characteristics of the 3 states



Source: USDOE, Energy Information Administration

CA, OR, and WA GHG emissions, 2000

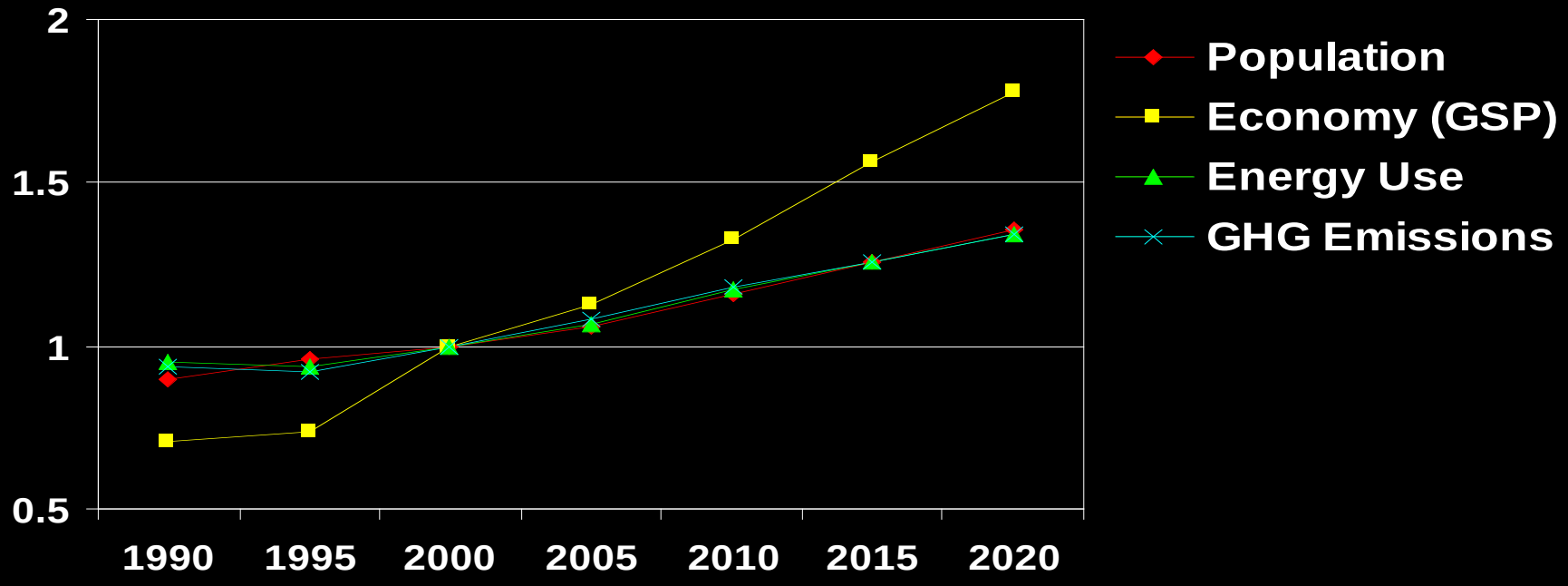
- 2.4% of global GHG emissions
- 8.9% of US emi



Methods for 3-state analysis

- Energy-related GHG emissions only, to 2020
- Data and assumptions from existing state estimates and studies, where available – iteration with WCG staff and working groups
- Spreadsheet analysis for most options, plus
  - Simple stock turnover modeling for light-duty vehicles
  - USDOE NEMS model for marginal electricity impacts
  - Double-counting avoided through an integrated approach (LEAP)
- Direct cost implications (NPV analysis)
- Electricity emissions based on in-state consumption (i.e. includes imports) rather than production

Base Case Projections – CA/OR/WA



- Projected population and economic growth rates are higher for California than for Oregon and Washington
- Base case includes existing policies (to the extent possible), such as California's current 20% Renewable Portfolio Standard (by 2017)

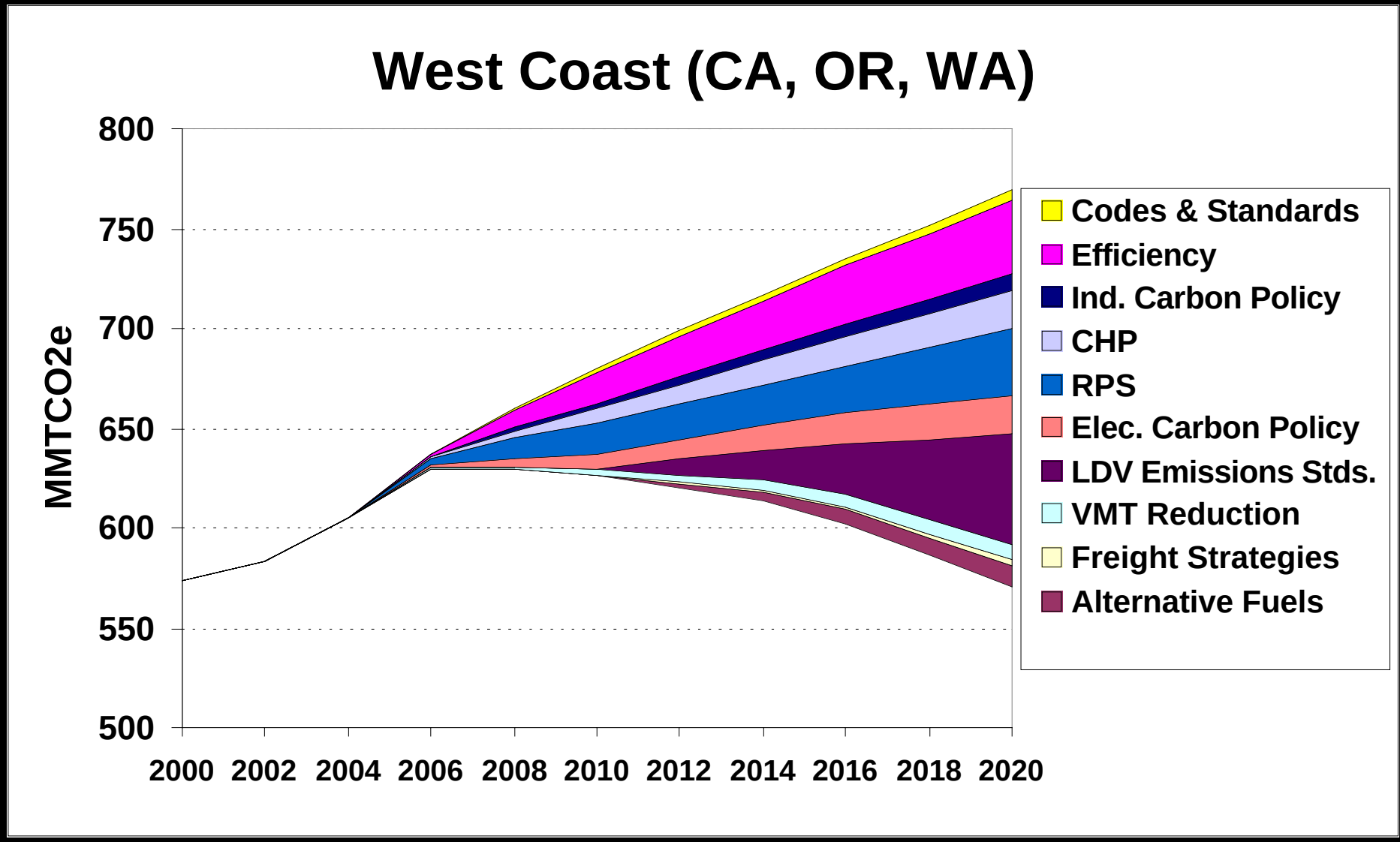
Buildings, Industry, & Electricity Strategies

Strategy Title	Description	Data Sources
Codes and Standards	Appliance standards, WA non-res building code.	ACEEE, CEC
Efficiency Programs	Cost-effective , achievable gas & electric potential	NWPC, CALMAC, OR En. Trust, others
Industry Carbon Policy	Voluntary commitments , negotiated agreements or cap & trade.	ACEEE, Tellus
Combined Heat and Power (CHP)	Barrier removal and incentive programs	Various USDOE studies
Renewable Portfolio Standard (RPS)	33% of 2020 sales in CA, 20% in OR and WA.	USDOE, CEC, True Wind, WSU, others
Electricity Sector Carbon Policy	Emissions portfolio std or cap & trade ($20/tCO2)	USDOE AEO 2004 (fuel prices)

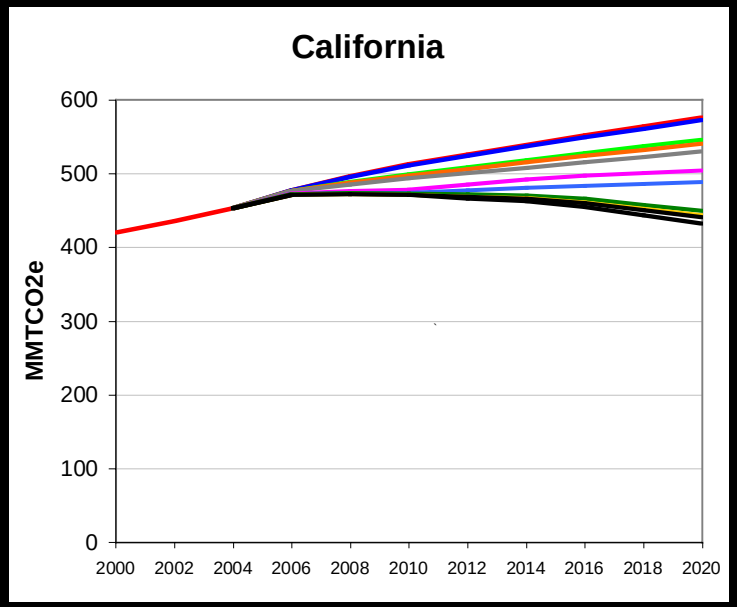
Transportation Strategies

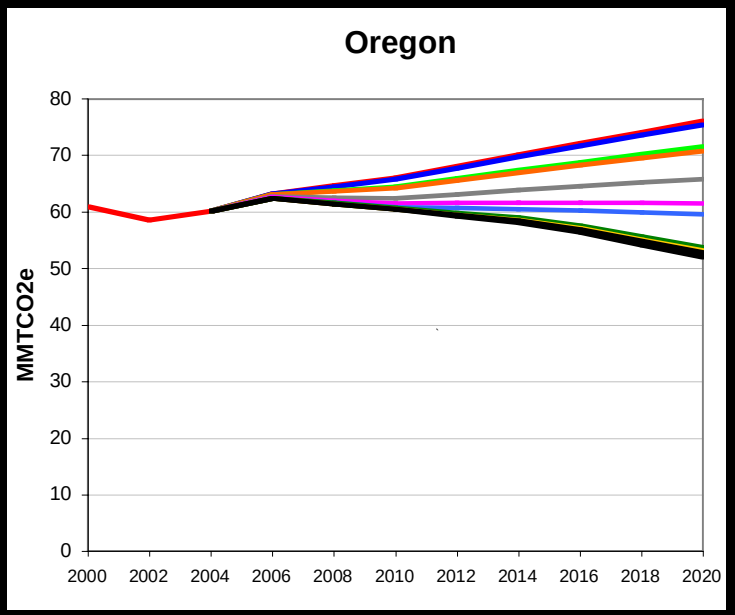
Strategy	Description	Data Sources
LDV GHG Emission Standards	? Reduce new LDV emissions (gCO2e/mi) by 30% in 2014, 50% in 2020.	CARB, USDOE AEO 2004
Alternative Vehicle Fuels	? H2 FCVs: 2% (new LDVs) ? Cellulosic Ethanol: 10% blend in gasoline ? Biodiesel: 20% blend in diesel.	CARB, USDOE, other
Vehicle Travel Reduction	? 5% reduction by 2020 via smart growth, transit, etc.	CEC, others
HDV GHG Emissions Improvement	? Reduce new HDV emissions (gCO2e/mi) by 20% in 2020	USDOE, others

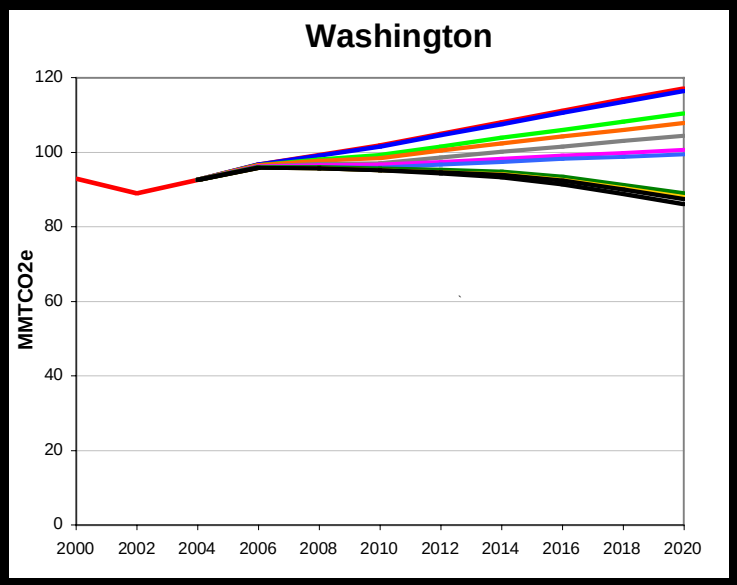
Combined Strategy Results, All 3 states



“Jaws” charts, by state







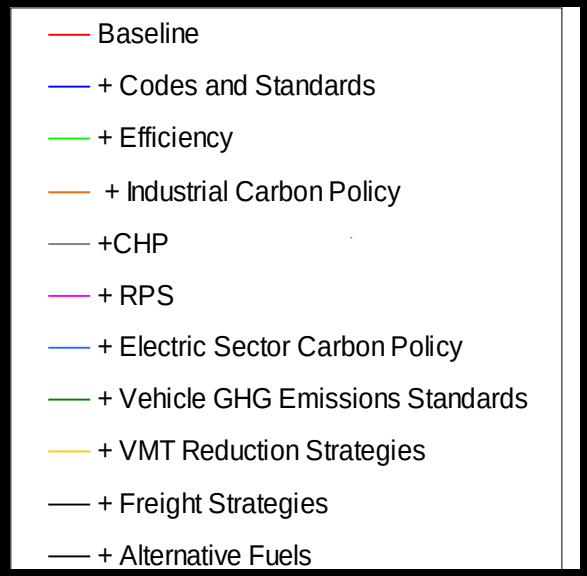


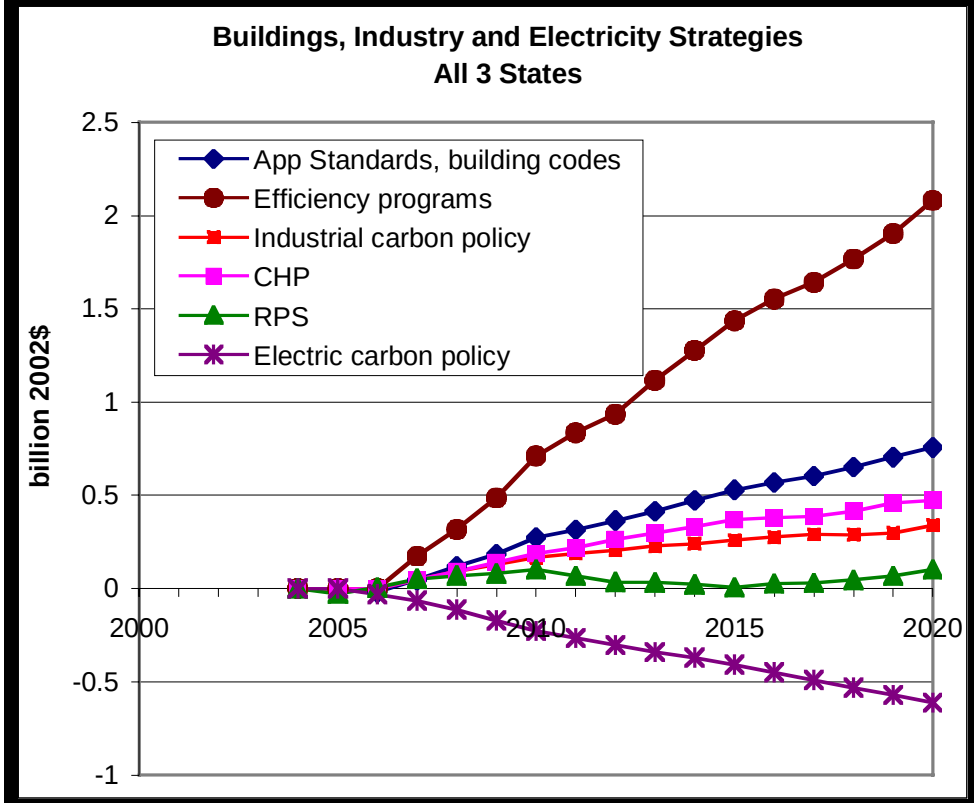
Table 2. GHG emissions before and after strategies

	Energy-Related Emissions (MMtCO2e)			
	1990	2000	2010	2020
California				
Base Case Emissions	408	424	516	579
Emissions after Strategies			474	436
Emissions relative to base case			*-8%*	*-25%*
Emissions relative to 2000			*+12%*	*+3%*
Emissions relative to 1990			*+16%*	*+7%*
Oregon				
Base Case Emissions	53	62	67	77
Emissions after Strategies			61	53
Emissions relative to base case			*-8%*	*-31%*
Emissions relative to 2000			*-1%*	*-15%*
Emissions relative to 1990			*+16%*	*-0%*
Washington				
Base Case Emissions	85	94	103	118
Emissions after Strategies			96	87
Emissions relative to base case			*-6%*	*-26%*
Emissions relative to 2000			*+2%*	*-7%*
Emissions relative to 1990			*+13%*	*+2%*
Regional Total				
Base Case Emissions	545	579	685	774
Emissions after Strategies			631	575
Emissions relative to base case			*-8%*	*-26%*
Emissions relative to 2000			*+9%*	*-1%*
Emissions relative to 19 90			*+16%*	*+6%*

Key Differences among the States

- Assumed Economic and Demographic Growth
  - lead to 1.6%/yr increase in California's GHG emissions, only 1.2%/yr in Oregon and Washington
- Coal in the current electricity mix
  - ~40% in OR, 20% in CA, 10% in WA
- Air travel and jet fuel use
  - Jet fuel accounts for 12-15% of projected CA emissions
  - If excluded from analysis, CA emissions would drop 8% overall between 2000 and 2020 (vs. 0% otherwise)

Figure 3. Annual Net Cost Savings of Individual Strategies, 2005-2020



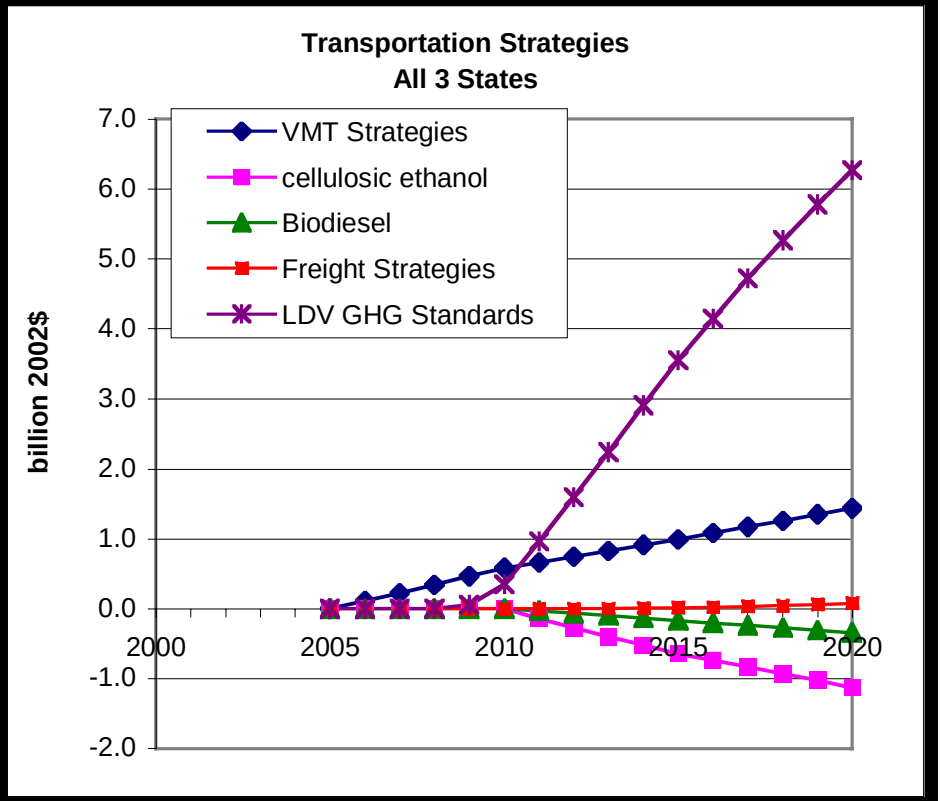


Table 4. Summary of Cost Savings, all 3 States

	Cost Savings in year: 2010	2020	Cumulative NPV Savings (2005 -2020)
Buildings and Industry			
Codes and Standards	$0.3	$0.8	$3.6
Efficiency Programs	$0.7	$2.1	$9.9
Industry Carbon Policy	$0.2	$0.3	$1.9
Combined Heat and Power	$0.2	$0.5	$2.5
Electricity Supply			
Renewable Portfolio Standard	$0.1	$0.1	$0.5
Electric Sector Carbon Policy	-$0.2	-$0.6	-$3.0
Transportation			
LDV GHG Standards	$0.4	$6.3	$21.5
VMT Strategies	$0.6	$1.4	$7.5
Freight Strategies		$0.1	$0.2
Alternative Fuels		-$1.5	-$4.8
Total	**$2.1**	**$9.4**	**$39.7**

Cost-benefit elements not assessed

- environmental and other co-benefits, e.g.
  - local air pollution
  - import dependency
- indirect and macroeconomic impacts, e.g.
  - re-spending of energy savings on local goods and services
  - consumer response to changes in energy prices
  - investments and jobs shifts
- effects of reduced demand on gasoline, natural gas, and other fuel prices
- the climate-related benefit of reducing GHG emissions

Strategies not analyzed include:

- Deeper and faster VMT reductions (going beyond 5% by 2020 via pay-as-you drive insurance, transit, etc.)
- Jet fuel reductions (high-speed rail, route optimization, more efficient aircraft (e.g. 7E7), travel alternatives, etc.)
- Diesel use reduction (ports, truck stops, airports, etc.)
- Existing vehicle measures (low rolling-resistance tires, maintenance, congestion and speed management, etc.)
- Accelerated reduction in vehicle emission rates (fleet initiatives, incentives, etc.)
- Freight management (road to rail, shorter hauls, etc.)
- Building and community design (low GHG design incentives, advanced building codes)
- Additional appliance standards, including tighter standards for federally regulated appliances
- Fuel switching from coal/oil to gas
- Geological sequestration (e.g. power plant carbon capture and storage)
- All non-energy emissions sources
  - Increased carbon sequestration on farms and in forests
  - Waste management
  - Farm nutrient and manure management
  - Substitution or enhance recovery of HFCs

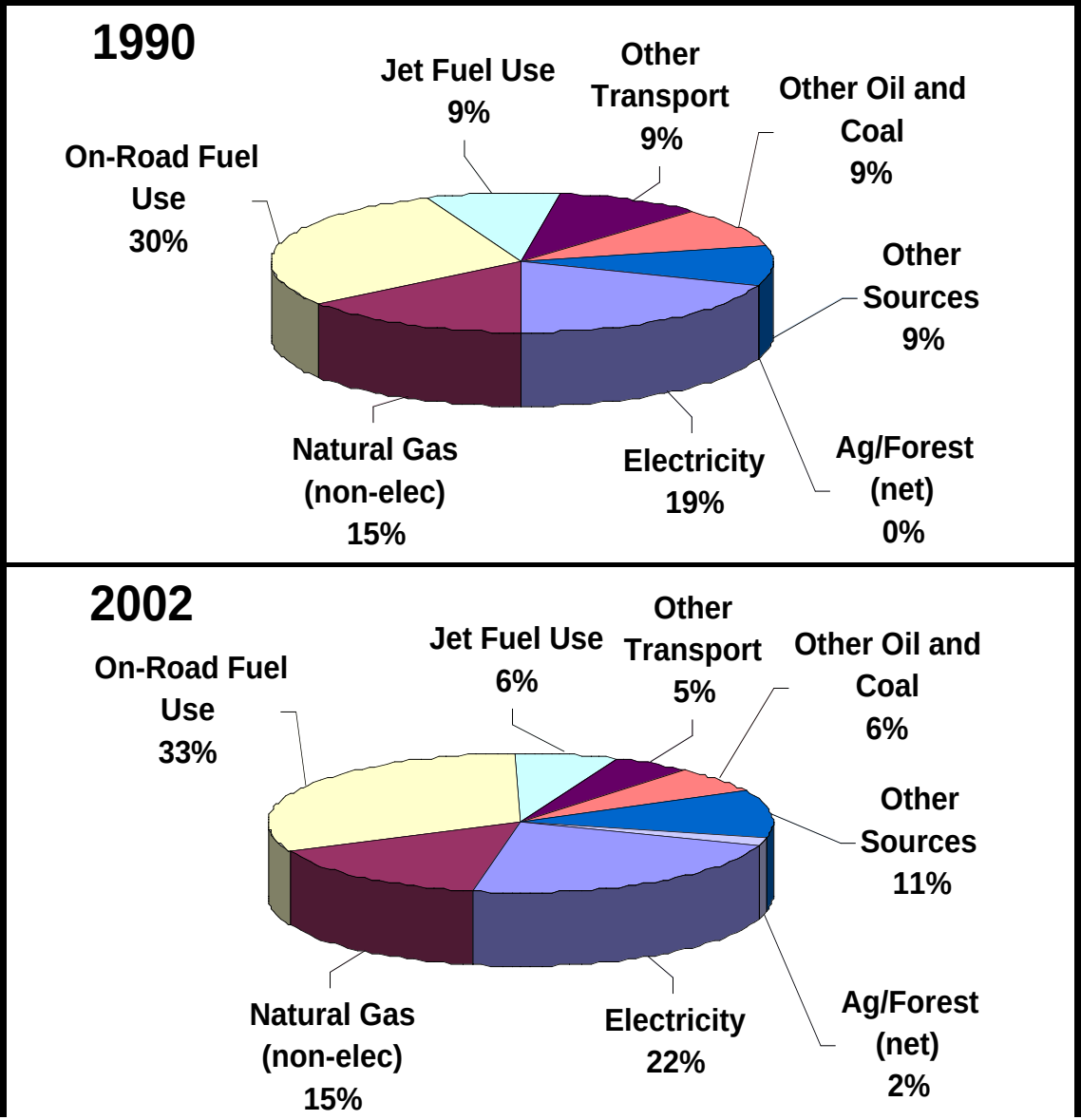
Summary of 3 state report

- Ten strategies could:
  - reduce West Coast emissions to 1% below 2000 levels by 2020 (26% below BAU), while the economy grows by 75-80%
  - provide nearly $40 billion in NPV savings through 2020
  - lead to deeper reductions after 2020 through full effects of vehicle standards, alternative fuel market development, infrastructure for carbon policy, smart growth/VMT, etc.
- Dozens of additional strategies could significantly increase the level of achievable emissions reductions

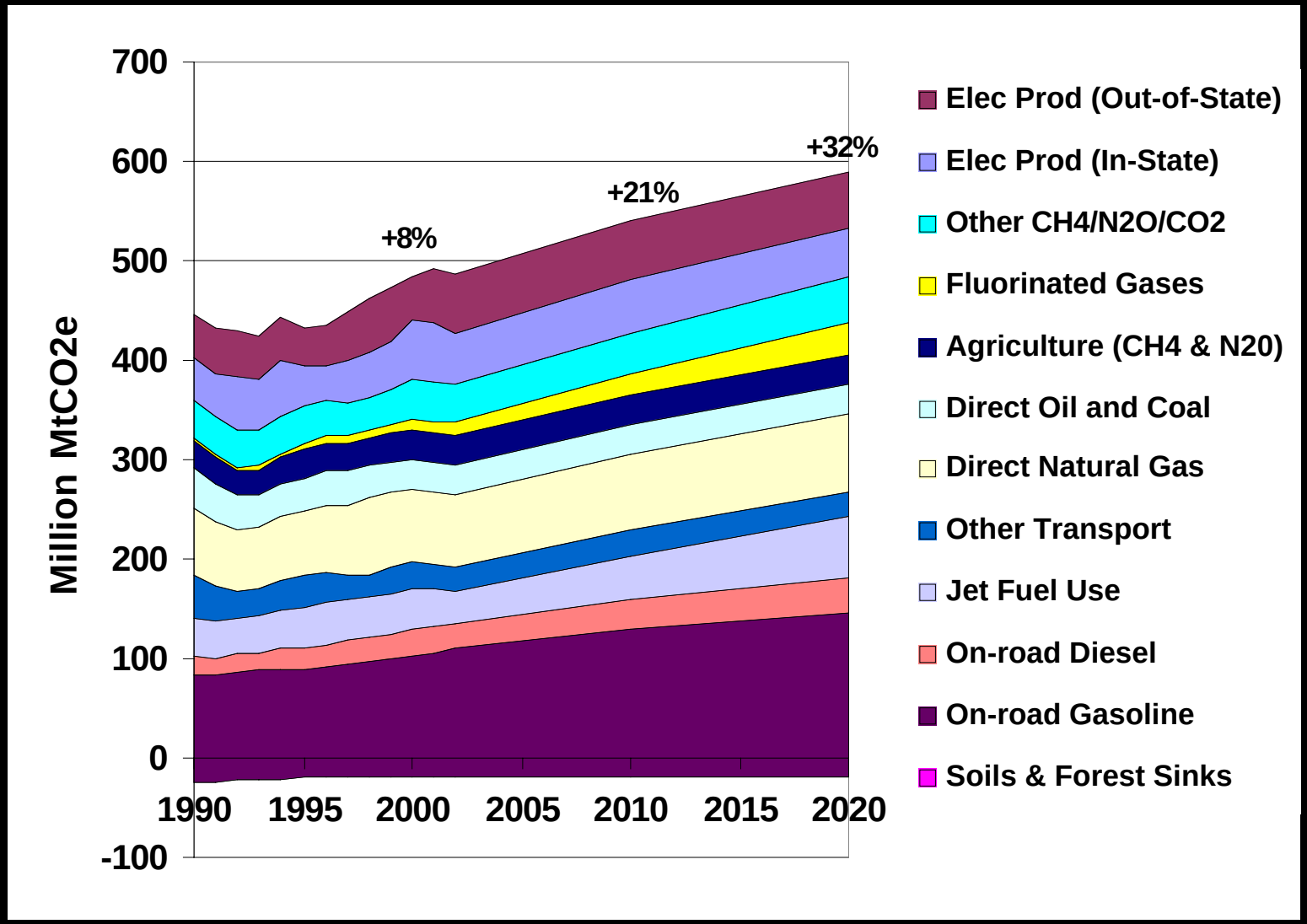
More on California GHG emissions (base case)

- Revisions to base case emissions estimates since August report include:
  - input and suggestions from agency experts
  - more detailed and updated consideration of fuels, sources, and data issues
  - non-energy and non-CO2 gases
  - recently approved or implemented policies (e.g. ethanol blending, 2005 building and appliance standards, etc.)

GHG Emissions by Source, 1990 and 2002

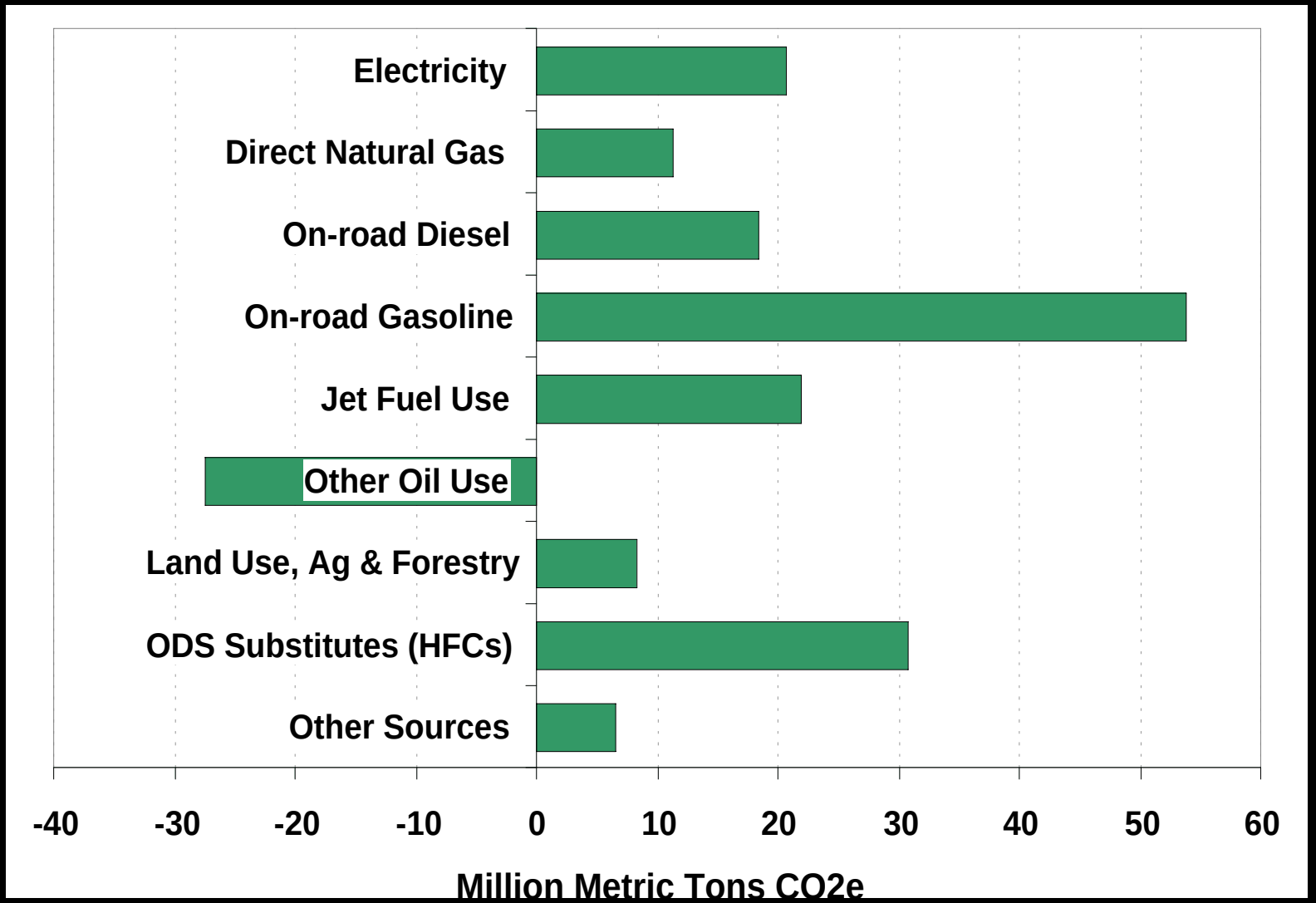


Base Case California GHG Emissions, 1990-2020



Note that soils and forest sinks are not shown correctly (average about -20 MMtCO2e)

Contributions to Emissions Growth, 1990-2020: Base case Projections



Base case GHG Emissions by Source

(Million Metric Tons CO_2e)	1990	2000	2010	2020	Explanatory Notes
Carbon Dioxide from Fuel Combustion					
Electricity Prod. (In-state)	43	60	56	59	CEC Electricity Forecast, 20% RPS by 2017
Electricity Prod. (Out-of-state)	*44*	*43*	*62*	*64*	Based CA Table J-11 and other sources
Direct Natural Gas Use	67	74	77	81	Derived from Natural Gas Outlook, Table E-5
Direct Coal Use	2	2	2	2	Assumes no change from 2002 levels
Direct Oil Use	40	28	28	28	Assumes no change from 2002 levels
On-road Gasoline	110	122	149	165	Based on most recent CEC forecast
On-road Diesel	19	26	32	37	Based on most recent CEC forecast
International 'Bunker Fuel' Use	20	10	10	10	Assumes no change from 1999 levels
Other Petroleum Use	20	15	15	15	Assumes no change from 1999 levels
Natural Gas Transportation	1	1	1	1	Assumes no change from 1999 levels
Jet Fuel Use	38	42	42	60	Based on most recent CEC forecast
Reductions from Other Recent Policies					
o Gasoline			-1	-2	Effects of 5.7% ethanol content in gasoline
o Electricity			-5	-15	Reflects 2005 building standards and CPUC energy savings goals
o Direct Fuel Use			-1	-2	
Subtotal for Carbon Dioxide	*405*	*423*	*467*	*503*	
Other GHG Emissions					
Agriculture (CH_4 & N_20)	27	29	29	29	No change from 1999 for most sources; manure from Draft PIER
Soils and Forest Sinks	-26	-19	-19	-19	Assumes no change from 1999 levels
ODS Substitutes (HFCs)	0	8	19	31	Based on draft PIER Program Forecast.
PFC from Semiconductor Ind.	0	2	2	2	Based on draft PIER Program Forecast
SF6 from Electric Utilities	2	0	0	0	Based on draft PIER Program Forecast
Cement & Other Industry	6	7	6	6	No change from 1999 for most sources; nitric acid from Draft PIER
Solid Waste Management	19	23	26	28	Draft PIER Program Forecast
CH_4 from Oil & Gas Systems	4	2	2	2	Draft PIER Program Forecast
CH_4 & N_2O from Fossil Fuels	9	8	8	8	Assumes no change from 1999 levels
Subtotal for Other GHGs	*41*	*60*	*74*	*87*	
Grand Total	**446**	**483**	**542**	**591**	

For more information:

The “Turning the Corner Report” is available at:

www.ef.org/westcoastclimate/B_Tellus_Turning_%20Corner.pdf

Contact:

Michael Lazarus, Tellus/SEI-B, mlaz@tellus.org

EXTRA SLIDES

Interpreting results

- Focus on overall emission reductions rather than individual strategy results
  - Utility carbon policy, renewable portfolio standards, travel reduction efforts, and alternative vehicle fuels could produce far greater emissions reductions than shown here if analyzed prior to, or in the absence of, other strategies
- Buildings, industry and electricity supply strategies could yield major emissions reductions *more rapidly* than transportation ones considered here
  - Technologies are commercial and widely available today (e.g. efficient lights and motors, wind turbines)
  - Strategies that transform vehicle technologies and fuels will continue to yield major reductions *after 2020*

Natural gas impacts

- Natural gas use is 19% lower than base case levels in 2020
- Could lead to significant reductions in gas prices (relative to the base case)

Natural gas use 1990-2020, base case and after all strategies, all 3 states

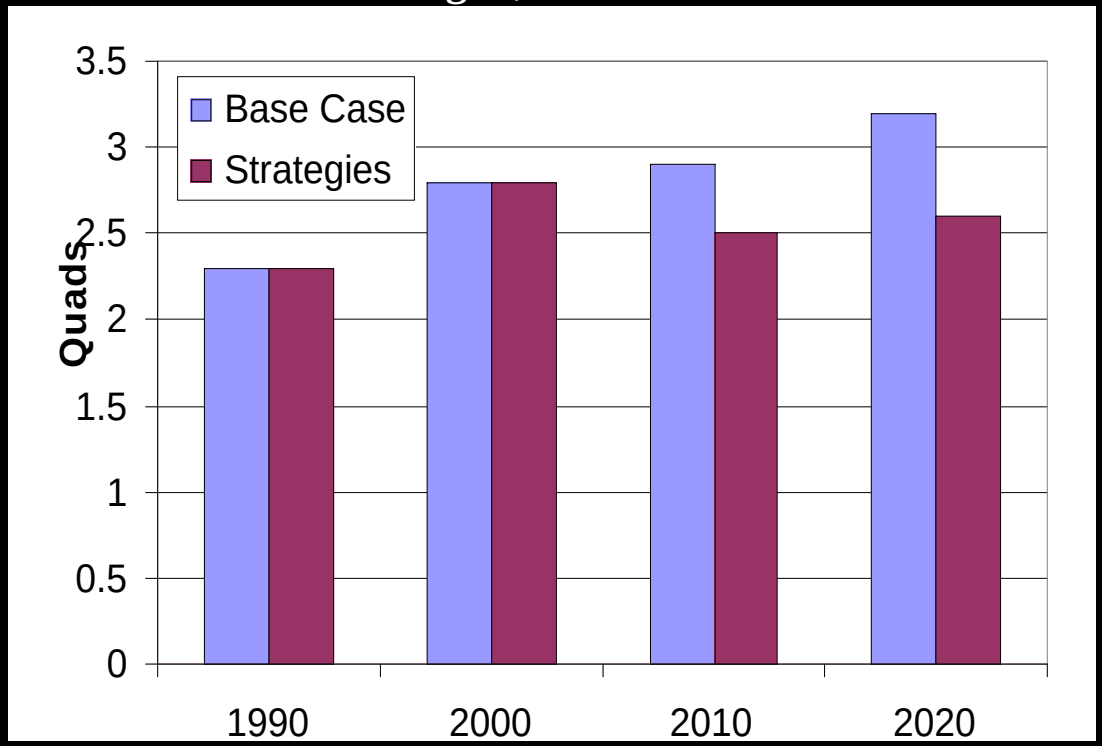


Table 1. Summary of CO2 Impacts by Strategy

	Emissions (MMtCO2e)					
	CA		OR		WA	
	2010	2020	2010	2020	2010	2020
Energy Emissions (Base Case)	516	579	67	77	103	118
Emissions Reductions						
Buildings and Industry St rategies						
Codes and Standards	2	4	0	1	0	1
Efficiency Programs*	12	27	1	4	2	6
Industry Carbon Policy	2	6	0	1	1	3
Combined Heat and Power*	4	10	2	5	1	3
Electricity Supply Strategies						
Renewable Portfolio Standard	15	26	1	4	0	4
Electricity Sector Carbon Policy	5	16	1	2	1	1
Transportation Strategies						
Light Duty Vehicle GHG Standards	0	39	0	6	0	10
VMT Strategies*	2	6	0	1	0	1
Freight Strategies	0	2	-	0	0	1
Alternative Fuels*	(0)	9	-	1	(0)	1
Total Reduc tions	42	144	6	24	7	31
Emissions After Strategies	474	436	61	53	96	87
Percent Reduction (vs Base Case)	8%	25%	8%	31%	6%	26%

Zero values reflect reductions of less than 0.5 MMtCO2e